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Indian Standard
SPECIFICATION FOR
POTASSIUM PERMANGANATE
(*Second Revision*)

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SPECIFICATION FOR POTASSIUM PERMANGANATE

(*Second Revision*)

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Indian Standard
SPECIFICATION FOR
POTASSIUM PERMANGANATE
(*Second Revision*)

0. FOREWORD

0.1 This Indian Standard (Second Revision) was adopted by the Indian Standards Institution on 27 May 1980, after the draft finalized by the Inorganic Chemicals (Miscellaneous) Sectional Committee had been approved by the Chemical Division Council.

0.2 Potassium permanganate is used as an oxidizing agent mainly in the production of saccharin and benzoic acid; bleaching and decolourising ethereal oils, waxes and fatty materials; leather tanning; staining and preservation of wood; and as a deodorant and disinfectant.

0.3 This standard was first published in 1951 and revised in 1969. The standard is being revised again in the light of the latest developments in the technology. In this revision requirement for loss on heating has been introduced for technical and pure grades of the material; limit for sulphate has been lowered in case of technical grade; the limits for impurities, namely, insoluble matter, nitrogen compounds and arsenic, have been lowered for analytical reagent grade of the material and limits for nitrogen compounds and arsenic have been introduced for pure grade of the material.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard prescribes the requirements and the methods of sampling and test for potassium permanganate.

2. GRADES

2.1 The material shall be of the following three grades:

- a) Technical,
- b) Pure, and
- c) Analytical reagent (AR).

3. REQUIREMENTS

3.1 Description

3.1.1 Potassium permanganate of technical grade shall be in the form of dark purple powder or irregular crystals or conglomerates.

3.1.2 Potassium permanganate of pure and analytical reagent grades shall be in the form of dark purple crystals having a metallic lustre.

3.2 The material shall also comply with the requirements laid down in Table 1, when tested according to the methods prescribed in Appendix A. Reference to the relevant clauses of the appendix are given in col 6 of the table.

TABLE 1 REQUIREMENTS FOR POTASSIUM PERMANGANATE

Sl. No.	CHARACTERISTIC	REQUIREMENT			METHOD OF TEST (REF TO CL No. IN APPENDIX A)
		Technical Grade	Pure Grade	AR Grade	
(1)	(2)	(3)	(4)	(5)	(6)
i)	Potassium permanganate (as KMnO_4) content, percent by mass, <i>Min</i>	98	99	99.5	A-2
ii)	Insoluble matter, percent by mass, <i>Max</i>	1.0	0.3	0.05	A-3
iii)	Chlorides (as Cl), percent by mass, <i>Max</i>	0.1	0.01	0.005	A-4
iv)	Sulphates (as SO_4), percent by mass, <i>Max</i>	0.2	0.05	0.005	A-5
v)	Nitrogen compounds (as N), percent by mass, <i>Max</i>	—	0.3	0.003	A-6
vi)	Arsenic (as As_2O_3), percent by mass, <i>Max</i>	—	0.01	0.000 1	A-7
vii)	Loss on heating at 110°C , percent by mass, <i>Max</i>	1.0	0.5	—	A-8

4. PACKING AND MARKING

4.1 Packing

4.1.1 The material of technical grade shall be packed in drums with polyethylene lining or in other suitable well-closed containers. It shall be kept away from easily oxidizable substances and fibrous materials.

4.1.2 The material of pure grade shall be packed in drums with polyethylene lining or airtight bottles.

4.1.3 The material of analytical reagent grade shall be preferably packed in amber coloured airtight glass bottles.

NOTE — Great care should be taken in handling potassium permanganate, as dangerous explosions are liable to occur if it is brought in contact with organic or other readily oxidizable substances either in solution or in the dry condition.

4.2 Marking — The containers shall be marked with the following information:

- a) Name and grade of the material;
- b) Manufacturer's name and recognized trade-mark, if any;
- c) Mass of the material in the package;
- d) Date of manufacture; and
- e) Identification in code or otherwise to enable the batch of manufacture to be traced from records.

4.2.1 In case of analytical reagent grade, the chemical analysis of the material in respect of the characteristics specified in Table 1 shall also appear on the label.

4.2.2 The containers may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

5. SAMPLING

5.1 The method of drawing representative samples of the material, number of tests to be performed and the criteria for conformity of the material to the requirements of this specification shall be as prescribed in Appendix B.

APPENDIX A

(Clause 3.2)

METHODS OF TEST FOR POTASSIUM PERMANGANATE

A-1. QUALITY OF REAGENTS

A-1.1 Unless specified otherwise, pure chemicals and distilled water (*see* IS : 1070-1977*) shall be employed.

NOTE — ' Pure chemicals ' shall mean chemicals that do not contain impurities which affect the result of analysis.

A-2. DETERMINATION OF POTASSIUM PERMANGANATE CONTENT

A-2.0 Outline of the Method — Potassium permanganate content is determined by titration against standard sodium oxalate solution.

A-2.1 Preparation of Solution — Dry about 2 g of the material at about 110°C to constant mass. Transfer 0.8 g of the dried material, accurately weighed, into a 250-ml volumetric flask. Dissolve in water and make up the volume to the mark.

A-2.2 Reagents

A-2.2.1 Standard Sodium Oxalate Solution — 0.1 N. Freshly prepared.

A-2.2.2 Dilute Sulphuric Acid — 5 N.

A-2.3 Procedure — Take 25 ml of standard sodium oxalate solution and mix with 15 ml of sulphuric acid and 25 ml of water. Heat the solution to about 60°C and titrate with the prepared solution till a pink colour, persistent for one minute, is obtained with one drop of it. Record the volume in millilitres of the prepared solution required for the titration.

A-2.4 Calculation — Calculate the mass of potassium permanganate (KMnO_4) on the basis that 1 ml of normal sodium oxalate solution is equivalent to 0.031 60 g of potassium permanganate, and express the result as percentage of the mass of the material taken for the test.

A-3. DETERMINATION OF MATTER INSOLUBLE IN WATER

A-3.1 Procedure — Weigh accurately about 2 g of the material and dissolve in 100 ml of hot water (at about 50°C). Filter through a Gooch crucible or a sintered glass crucible No. G4. Wash until washings are

*Specification for water, for general laboratory use (*second revision*).

colourless and dry at about 105°C till constant mass is obtained. For AR grade, use 20 g of the material.

A-3.2 Calculation

$$\frac{\text{Matter insoluble in water,}}{\text{percent by mass}} = 100 \frac{M_1}{M_2}$$

where

M_1 = mass in g of the dried residue, and

M_2 = mass in g of the material taken for the test.

A-4. CHLORIDES

A-4.0 Outline of the Method — Chlorides are determined by comparing the opalescence produced by the material with silver nitrate solution against that produced by a standard chloride solution.

A-4.1 Apparatus

A-4.1.1 Nessler Cylinders — 50 ml capacity (see IS : 4161-1967*).

A-4.2 Reagents

A-4.2.1 Concentrated Nitric Acid — see IS : 264-1976†.

A-4.2.2 Silver Nitrate Solution — 5 percent (*m/v*).

A-4.2.3 Standard Chloride Solution — Dissolve 1.649 g of sodium chloride in water and make up the volume to 1 000 ml. Pipette out 10 ml of the solution, dilute with water and make up the volume to 100 ml. One millilitre of this solution contains 0.1 mg of chlorides (as Cl).

A-4.2.4 Hydrogen Peroxide — 35 percent (*m/m*).

A-4.3 Procedure — Dissolve 1.0 g of the material in water. Transfer to a Nessler cylinder and add 1 ml of concentrated nitric acid, 1 ml of silver nitrate solution and enough quantity of hydrogen peroxide to completely decolourize the permanganate colour. When the solution is completely decolourized, dilute it to the mark with water. Carry out a control test in the other Nessler cylinder using 10 ml of standard chloride solution in case of technical grade, 1 ml in case of pure grade and 0.5 ml in case of analytical reagent grade of the material, and the same quantities of other reagents in the same total volume of the reaction mixture. Stir both the solutions with glass rods and compare the opalescence produced in the two cylinders after 5 minutes.

*Specification for Nessler cylinders.

†Specification for nitric acid (*second revision*).

A-4.3.1 The limit shall be taken as not having been exceeded if the opalescence produced in the test with the material is not greater than that produced in the control test.

A-5. SULPHATES

A-5.1 For Technical Grade

A-5.1.0 Outline of the Method — Sulphates are determined by precipitating with barium chloride solution.

A-5.1.1 Reagents

A-5.1.1.1 Concentrated hydrochloric acid — see IS : 265-1976*.

A-5.1.1.2 Hydrogen peroxide — 35 percent (*m/m*).

A-5.1.1.3 Dilute hydrochloric acid — approximately 5 N.

A-5.1.1.4 Barium chloride solution — approximately 10 percent (*m/v*).

A-5.1.2 Procedure — Weigh accurately about 10 g of the material and dissolve in 100 ml of water. Add this solution slowly to a mixture consisting of 14 ml of concentrated hydrochloric acid, 30 ml of water and 5 ml of hydrogen peroxide. Evaporate the solution to dryness. Dissolve the residue in 10 ml of dilute hydrochloric acid and dilute to 200 ml with water. Heat the solution to boiling and add, drop by drop, 10 ml of barium chloride solution. Boil the solution for 15 minutes and then allow to stand for 4 hours. Filter through a tared Gooch crucible or a sintered glass crucible No. G4. Wash the precipitate thoroughly with hot water till it is free from chlorides and dry to constant mass at 105 to 110°C.

A-5.1.3 Calculation

$$\text{Sulphates (as SO}_4 \text{), percent by mass} = 41.15 \frac{A}{M}$$

where

A = mass in g of the precipitate, and

M = mass in g of the material taken for the test.

A-5.2 For Pure and Analytical Reagent Grades

A-5.2.0 Outline of the Method — Sulphates are determined by comparing the turbidity produced by the material with barium chloride solution against that produced by a standard sulphate solution.

*Specification for hydrochloric acid (*second revision*).

A-5.2.1 Apparatus

A-5.2.1.1 Nessler cylinders — 50 ml capacity (see IS : 4161-1967*).

A-5.2.2 Reagents

A-5.2.2.1 Dilute hydrochloric acid — approximately 5 N.

A-5.2.2.2 Standard sulphate solution — Dissolve 0.1814 g of potassium sulphate in water and make up the volume to 1000 ml. Take 10 ml of this solution and dilute it further to 100 ml. One millilitre of the final solution is equivalent to 0.01 mg of sulphate (as SO_4).

A-5.2.2.3 Barium chloride solution — approximately 10 percent (m/v).

A-5.2.2.4 Hydrogen peroxide — 35 percent (m/v).

A-5.2.3 Procedure — Weigh accurately 0.2 g of the material and dissolve in 25 ml of hot water. Add this solution slowly to a mixture consisting of 7 ml of dilute hydrochloric acid, 15 ml of water and 5 ml of hydrogen peroxide. Evaporate the solution to dryness. Dissolve the residue in 1 ml of dilute hydrochloric acid and 10 ml of warm water and filter if necessary. Transfer the solution to a Nessler cylinder and add 2 ml of barium chloride solution, stir the mixture and allow to stand for 20 minutes. Carry out a control test in the other Nessler cylinder using 10 ml of standard sulphate solution in case of pure grade and 1 ml in case of analytical reagent grade of the material, and the same quantities of other reagents, finally diluting to the mark.

A-5.2.3.1 The limit shall be taken as not having been exceeded if the turbidity produced in the test with the material is not greater than that produced in the control test.

A-6. NITROGEN COMPOUNDS (ASN)

A-6.0 Outline of the Method — Nitrogen compounds are determined with the help of Nessler solution which reacts with ammonia to form a reddish brown colloidal suspension.

A-6.1 Reagents

A-6.1.1 Concentrated Sulphuric Acid — see IS : 266-1977†.

A-6.1.2 Oxalic Acid — solid.

A-6.1.3 Dilute Hydrochloric Acid — 0.1 N.

*Specification for Nessler cylinders.

†Specification for sulphuric acid (second revision).

A-6.1.4 Sodium Hydroxide Solution — 10 percent (*m/v*).

A-6.1.5 Aluminium Wire

A-6.1.6 Nessler Solution — Dissolve 10 g of potassium iodide in 10 ml of ammonia-free water and add to it slowly with stirring saturated mercuric chloride solution until a slight permanent precipitate is formed. Add 30 g of potassium hydroxide and when it has dissolved, add 1 ml more of mercuric chloride solution, and dilute to 200 ml with ammonia-free water. Allow to settle overnight, decant the clear solution and keep it in a bottle closed with a well-fitting rubber stopper.

A-6.2 Procedure — Dissolve 1.0 g of the material in 100 ml of water in a flask and add 1 ml of concentrated sulphuric acid and 2.5 mg of oxalic acid. When the solution is clear, connect the flask through a spray trap to a condenser, the end of which is beneath the surface of 10 ml of dilute hydrochloric acid. Add to the flask 40 ml of freshly boiled sodium hydroxide solution and 0.5 g of aluminium wire in small pieces. Allow to stand for 1 hour, distil about 60 ml and dilute the distillate to 100 ml. To 25 ml of the distillate add 1 ml of sodium hydroxide solution, dilute to 50 ml and add 2 ml of Nessler solution. Carry out a control test in the similar way using 12 mg of ammonium chloride in case of pure grade of the material, and 0.04 mg in case of analytical reagent grade of the material in place of the material.

A-6.2.1 The limit shall be taken as not having been exceeded if the colour produced in the test with the material is not deeper than that produced in the control test.

A-7. ARSENIC (*AS* As_2O_3)

A-7.1 Reagents

A-7.1.1 Concentrated Hydrochloric Acid — see IS : 265-1976*.

A-7.1.2 Stannous Chloride Solution — 30 percent (*m/v*).

A-7.2 Procedure

A-7.2.1 Preparation of Solution — Weigh accurately 1.0 g of the material and add a cooled mixture of 10 ml of concentrated hydrochloric acid and 10 ml of water. When the first reaction has subsided, heat to remove chloride. Cool, remove the last traces of chloride with a few drops of stannous chloride solution and add 20 ml of water.

A-7.2.2 Carryout the test for arsenic as prescribed in 5.1 of IS : 2088-1971† using for comparison a stain obtained with 0.1 mg of arsenic

*Specification for hydrochloric acid (*second revision*).

†Methods for determination of arsenic (*first revision*).

trioxide (as As_2O_3) in case of pure grade of the material and 0.001 mg in case of analytical reagent grade of the material.

A-7.2.2.1 The limit prescribed in Table 1 shall be taken as not having been exceeded if the length of the stain as well as the intensity of its colour produced in the test with the material is not greater than that produced in the control test.

A-8. LOSS ON HEATING AT 110°C

A-8.1 Procedure — Weigh accurately about 10 g of the material ground to powder into a tared shallow dish and dry to constant mass $110 \pm 2^\circ\text{C}$.

A-8.2 Calculation

$$\text{Loss on heating at } 110^\circ\text{C} = 100 \frac{M_1}{M}$$

where

M_1 = loss in mass in g, and

M = mass in g of the material taken for the test.

APPENDIX B

(Clause 5.1)

SAMPLING AND CRITERIA FOR CONFORMITY OF POTASSIUM PERMANGANATE

B-1. GENERAL REQUIREMENTS OF SAMPLING

B-1.0 In drawing samples, the following precautions and directions shall be observed.

B-1.1 Samples shall not be taken in an exposed place.

B-1.2 The sampling implement shall be clean and dry when used.

B-1.3 Precautions shall be taken to protect the samples, the material being sampled, the sampling implement and the containers for samples from adventitious contaminations.

B-1.4 To draw a representative sample, the contents of each container selected for sampling shall be mixed thoroughly by suitable means.

B-1.5 The samples shall be placed in suitable, clean, dry and airtight glass containers which shall be sealed airtight after filling and marked with full details of sampling.

B-2. SCALE OF SAMPLING

B-2.1 Lot — In a single consignment of the material all the containers of the same size and containing the same grade of material and drawn from the same batch of manufacture shall constitute a lot. If a consignment is known to consist of different batches of manufacture or of different types or sizes of containers, those belonging to the same batch, type and size shall be grouped together and each such group shall constitute a separate lot.

B-2.1.1 For ascertaining the conformity of the material in a lot to the requirements of the specification, tests shall be carried out for each lot separately. The number of containers to be selected at random from lots of different sizes shall be in accordance with Table 2.

TABLE 2 SCALE OF SAMPLING

LOT SIZE	SAMPLE SIZE
<i>N</i>	<i>n</i>
(1)	(2)
Up to 25	3
26 „ 50	4
51 „ 100	5
101 and above	7

B-2.1.2 The containers to be selected for sampling shall be chosen at random and in order to ensure randomness of selection IS : 4905-1968* may be followed.

B-3. PREPARATION OF TEST SAMPLES

B-3.1 From each of the containers selected, draw a representative portion of potassium permanganate approximately 75 g in mass.

B-3.2 Out of these portions, a small but equal quantity of the material shall be taken and mixed thoroughly by suitable means to form a composite sample of mass about 150 g. The composite sample shall be divided into three equal parts, one for the purchaser, another for the supplier and third to be used as a referee sample.

B-3.3 From the remaining portion of potassium permanganate from each container, about 25 g of the material shall be drawn and divided into three equal parts which shall then be transferred to three separate bottles with full identification particulars of the sample. The material in each

*Methods for random sampling.

bottle shall constitute individual sample. One of these three sets (each set containing n bottles representing n containers supplied) shall be for the purchaser, another for the supplier and the third shall be used as a referee sample.

B-3.4 The referee samples consisting of a composite sample and a set of individual samples shall bear the seal of both the purchaser and the supplier. They shall be kept at a place agreed to between the purchaser and the supplier and shall be used in case of dispute between the two.

B-4. NUMBER OF TESTS

B-4.1 Tests for the determination of potassium permanganate content shall be performed on each of the individual samples.

B-4.2 Tests for the determination of all the remaining characteristics given in 3 shall be carried out on the composite sample.

B-5. CRITERIA FOR CONFORMITY

B-5.1 For Potassium Permanganate Content — From the set of individual test results for potassium permanganate content, the average (\bar{X}) and the range (R) of the test results shall be computed as in Table 3. (Range R is determined as the difference between the maximum and the minimum test results.)

TABLE 3 CRITERIA FOR CONFORMITY FOR POTASSIUM
PERMANGANATE CONTENT

SL No.	GRADE	TEST RESULTS	AVERAGE	RANGE	CRITERIA FOR CONFORMITY
(1)	(2)	(3)	(4)	(5)	(6)
i)	Technical	1, 2, 3 ... n	\bar{X}_1	R_1	($\bar{X}_1 - 0.6 R_1$) shall be greater than or equal to 98
ii)	Pure	1, 2, 3 ... n	\bar{X}_2	R_2	($\bar{X}_2 - 0.6 R_2$) shall be greater than or equal to 99
iii)	Analytical reagent	1, 2, 3 ... n	\bar{X}_3	R_3	($\bar{X}_3 - 0.6 R_3$) shall be greater than or equal to 99.5.

B-5.2 For declaring the conformity of the lot to the requirements of all the other characteristics tested on the composite sample, the test results shall meet the corresponding requirements specified in 3.2.

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Panel for Percompounds, CDC 3 : 18 : 1

Convener

DR S. BANERJEE

Representing

National Peroxide Ltd, Bombay

Members

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Ministry of Defence (R & D)

SHRI S. P. SONTAKKE (Alternate)

SHRI A. K. KOHLI

The Swadeshi Chemicals Pvt Ltd, Bombay

SHRI D. V. PATWARDHAN (Alternate)

SHRI K. M. SHAH

The Millowners Association, Bombay

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	1 N = 1 kg.m/s ²
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m ²
Frequency	hertz	Hz	1 Hz = 1 c/s (s ⁻¹)
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m ²

INDIAN STANDARDS INSTITUTION

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones : 26 60 21, 27 01 31

Telegrams : Manakeanstha

Regional Offices:

		Telephone
Western : Novelty Chambers, Grant Road	BOMBAY 400007	37 97 29
Eastern : 5 Chowringhee Approach	CALCUTTA 700072	27 50 00
Southern : C. I. T. Campus, Adyar	MADRAS 600029	41 24 42

Branch Offices:

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'F' Block, Unity Bldg, Narasimharaja Square	BANGALORE 560002	2 76 49
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Ahmed Bldg, SCO 82-83, Sector 17C	CHANDIGARH 160017	2 03 20
5-8-56C L. N. Gupta Marg	HYDERABAD 500031	22 10 83
D-277 Todarmal Marg, Banipark	JAIPUR 302006	6 98 32
117/418 B Sarvodaya Nagar	KANPUR 203005	8 12 72
Patilputra Industrial Estate	PATNA 800013	6 28 08
Hantex Bldg (2nd Floor), Rly Station Road	TRIVANDRUM 695001	32 27